CLAIMS

1. A method of forming a field electron emission material, comprising the step of disposing on a substrate having an electrically conductive surface a plurality of electrically conductive particles, each with a layer of electrically insulating material disposed either in a first location between said conductive surface and said particle, or in a second location between said particle and the environment in which the field electron emission material is disposed, but not in both of said first and second locations, such that at least some of said particles form electron emission sites at said first or second locations where said electrically insulating material is disposed.

2. A method according to claim 1, wherein the dimension of said particles normal to the surface of the conductor is significantly greater than the thickness of said layer of insulating material.

3. A method according to claim 2, wherein said dimension substantially normal to the surface of said particle is at least 10 times greater than said thickness.

4. A method according to claim 3, wherein said dimension substantially normal to the surface of said particle is at least 100 times greater than each said thickness.

5. A method according to ~~any of claims 1 to 4,~~ claim 1 wherein the thickness of said insulating material is in the range 10 nm to 100 nm (100 Å to 1000 Å) and said particle dimension is in the range 1μm to 10 μm.

6. A method according to ~~any of claims 1 to 5~~ claim 1, wherein there is provided a substantially single layer of said conductive particles each having their dimension substantially normal to the surface in the range 0.1 μm to 400 μm.

7. A method according to ~~any of the preceding claims~~ claim 1, wherein said insulating material comprises a material other than diamond.

8. A method according to ~~any of the preceding claims~~ claim 1, wherein said insulating material is an inorganic material.

9. A method according to ~~any of the preceding claims~~ claim 1, wherein said insulating material comprises a glass, lead based glass, glass ceramic, melted glass or other glassy material, ceramic, oxide ceramic, oxidised surface, nitride, nitrided surface, boride ceramic, diamond, diamond-like carbon or tetragonal amorphous carbon.

10. A method according to ~~any of the preceding claims~~ claim 1, wherein each said electrically conductive particle is substantially symmetrical.

11. A method according to ~~any of the preceding claims~~ claim 1, wherein each said electrically conductive particle is of substantially rough-hewn cuboid shape.

12. A method according to ~~any of claims 1 to 10~~ claim 1, wherein each said electrically conductive particle is of substantially spheroid shape with a textured surface.

13. A method according to ~~any of claims 1 to 11~~ claim 1, wherein said conductive particles each have a longest dimension and are preferentially aligned with their longest dimension substantially normal to the substrate.

14. A method according to ~~any of the preceding claims~~ claim 1, wherein said conductive particles having a mutual spacing, centre-to-centre, of at least 1.8 times their smallest dimension.

15. A method according to ~~any of the preceding claims~~ claim 1, wherein each said particle is, or at least some of said particles are, selected from the group comprising metals, semiconductors, electrical conductors, graphite, silicon carbide, tantalum carbide, hafnium carbide, zirconium carbide, boron carbide, titanium diboride, titanium carbide, titanium carbonitride, the Magneli sub-oxides of titanium, semi-conducting silicon, III-V compounds and II-VI compounds.

16. A method according to ~~any of the preceding claims~~ claim 1, wherein each said particle, or at least some of said particles, are only partially covered in said insulating material, and each such particle comprises a gettering material.

17. A method according to ~~any of the preceding claims~~ claim 1, wherein said surface is coated with said particles by means of an ink containing said particles and said insulating material to form said insulating layer, the properties of said ink being such that said particles have portions which are caused to project from said insulating material, uncoated by the insulating material, as a result of the coating process.

18. A method according to claim 17, wherein said ink is applied to said electrically conductive surface by a printing process.

19. A method according to ~~any of the preceding claims~~ claim 1, wherein said electrically conductive particles and/or electrically insulating material are applied to said electrically conductive substrate in a photosensitive binder to permit later patterning.

claim 1

20. A method according to ~~any of the preceding claims~~, wherein said insulating material is formed by the step of fusing, sintering or otherwise joining together a mixture of particles or *in situ* chemical reaction.

21. A method according to claim 20, wherein the insulating material comprises a glass, glass ceramic, ceramic, oxide ceramic, oxide, nitride, boride, diamond, polymer or resin.

claim 1

22. A method according to ~~any of the preceding claims~~, wherein each said electrically conductive particle comprises a fibre chopped into a length longer than its diameter.

claim 1

23. A method according to any of ~~claims 1 to 21~~, wherein said particles are formed by the deposition of a conducting layer upon said insulating layer and subsequent patterning, either by selective etching or masking, to form isolated islands that function as said particles.

claim 1

24. A method according to ~~any of claims 1 to 21~~, wherein said particles are applied to said conductive surface by a spraying process.

claim 1

25. A method according to ~~any of claims 1 to 21~~, wherein said conductive particles are formed by depositing a layer that subsequently crazes, or is caused to craze, into substantially electrically isolated raised flakes.

26. A method according to claim 23, ~~24 or 25,~~ wherein said conducting layer comprises a metal, conducting element or compound, semiconductor or composite.

27. A method according to ~~any of the preceding claims~~ Claim 1, wherein the distribution of said sites over the field electron emission material is random.

28. A method according to ~~any of the preceding claims~~ Claim 1, wherein said sites are distributed over the field electron emission material at an average density of at least 10^2 cm^{-2}.

29. A method according to ~~any of the preceding claims~~ Claim 1, wherein said sites are distributed over the field electron emission material at an average density of at least 10^3 cm^{-2}, 10^4 cm^{-2} or 10^5 cm^{-2}.

30. A method according to ~~any of the preceding claims~~ Claim 1, wherein the distribution of said sites over the field electron emission material is substantially uniform.

31. A method according to claim 30, wherein the distribution of said sites over the field electron emission material has a uniformity such that the density of said sites in any circular area of 1mm diameter does not vary by more than 20% from the average density of distribution of sites for all of the field electron emission material.

32. A method according to claim 30, wherein the distribution of said sites over the field electron emission material when using a circular measurement area of 1 mm in diameter is substantially Binomial or Poisson.

33. A method according to claim 30, wherein the distribution of said sites over the field electron emission material has a uniformity such that there is at least a 50% probability of at least one emitting site being located in any circular area of 4 μm diameter.

AMENDED SHEET
IPEA/EP

34. A method according to claim 30, wherein the distribution of said sites over the field electron emission material has a uniformity such that there is at least a 50% probability of at least one emitting site being located in any circular area of 10 μm diameter.

35. A method according to any of the preceding claims, including the preliminary step of classifying said particles by passing a liquid containing particles through a settling tank in which particles over a predetermined size settle such that liquid output from said tank contains particles which are less than said predetermined size and which are then coated on said substrate.

36. A field electron emission material produced by a method according to claim 1 ~~any of the preceding claims.~~

37. A field electron emission device comprising a field electron emission material according to claim 36 and means for subjecting said material to an electric field in order to cause said material to emit electrons.

38. A field electron emission device according to claim 37, comprising a substrate with an array of emitter patches of said field electron emission material, and control electrodes with aligned arrays of apertures, which electrodes are supported above the emitter patches by insulating layers.

39. A field electron emission device according to claim 38, wherein said apertures are in the form of slots.

40. A field electron emission device according to claim 37 ~~any of claims 37 to 39,~~ comprising a plasma reactor, corona discharge device, silent

discharge device, ozoniser, an electron source, electron gun, electron device, x-ray tube, vacuum gauge, gas filled device or ion thruster.

41. A field electron emission device according to ~~any of claims 37 to 40~~ claim 37, wherein the field electron emission material supplies the total current for operation of the device.

42. A field electron emission device according to any of claims 37 to 40, wherein the field electron emission material supplies a starting, triggering or priming current for the device.

43. A field electron emission device according to ~~any of claims 37 to 42~~ claim 37, comprising a display device.

44. A field electron emission device according to ~~any of claims 37 to 42~~ claim 37, comprising a lamp.

45. A field electron emission device according to claim 44, wherein said lamp is substantially flat.

46. A field electron emission device according to ~~any of claims 37 to 45~~ claim 37, comprising an electrode plate supported on insulating spacers in the form of a cross-shaped structure.

47. A field electron emission device according to ~~any of claims 37 to 46~~ claim 37, wherein, the field electron emission material is applied in patches which are connected in use to an applied cathode voltage via a resistor.

48. A field electron emission device according to claim 47, wherein said resistor is applied as a resistive pad under each emitting patch.

49. A field electron emission device according to claim 48, wherein a respective said resistive pad is provided under each emitting patch, such that the area of each such resistive pad is greater than that of the respective emitting patch.

50. A field electron emission device according to ~~any of claims 37 to 49~~ claim 37, wherein said emitter material and/or a phosphor is/are disposed upon one or more one-dimensional array of conductive tracks which are arranged to be addressed by electronic driving means so as to produce a scanning illuminated line.

51. A field electron emission device according to claim 50, including said electronic driving means.

52. A field electron emission device according to ~~any of claims 37 to 51~~ claim 37, wherein said environment is gaseous, liquid, solid, or a vacuum.

53. A field electron emission device according to ~~any of claims 37 to 52~~ claim 37, including a gettering material within the device.

54. A field electron emission device according to claim 53, wherein said gettering material is affixed to an anode of the device.

55. A field electron emission device according to claim 53 ~~or 54~~, wherein said gettering material ~~may be~~ is affixed to a cathode of the device.

56. A field electron emission device according to claim 55, wherein said field electron emission material is arranged in patches, and said gettering material is disposed within said patches.

57. A field electron emission device according to claim 53, comprising an anode, a cathode, spacer sites on said anode and cathode, spacers

located at at least some of said spacer sites to space said anode from said cathode, and said gettering material located on said anode at others of said spacer sites where spacers are not located.

58. A field electron emission device according to claim 57, wherein said spacer sites are at a regular or periodic mutual spacing.

59. A field electron emission device according to claim 37 ~~any of claims 37 to 58~~, wherein a cathode of the device is optically translucent and so arranged in relation to an anode of the device that electrons emitted from the cathode impinge upon the anode to cause electro-luminescence at the anode, which electro-luminescence is visible through the optically translucent cathode.

ADD A1

plate by spacers 179 and the structure sealed and evacuated in the same manner as the lamp shown in Figure 10a. The anode plate 177 which may be of glass, ceramic, metal or other suitable material has disposed upon it a layer of a electroluminescent phosphor 175 with an optional reflective layer 176, such as aluminum, between the phosphor and the anode plate. A voltage 180 in the kilovolt range is applied between the conducting layer 171 and the anode plate 177 (or in the case of insulating materials a conducting coating thereon). Field emitted electrons 173 caused by said applied voltage are accelerated to the phosphor 175. The resulting light output 174 passes through the translucent emitter 172 and transparent conducting layer 171. An optional Lambertian or non-Lambertian diffuser 178 may be disposed in the optical path. Similar approaches may be used to increase the luminance of addressable displays.

Cont'd B8

In the Claims

Amend claims 60 and 61 as follows:

B9

60. (Amended) A method according to claim 24, wherein said conducting layer comprises a metal conducting element or compound, semiconductor or composite.

61. (Amended) A method according to claim 25, wherein said conducting layer comprises a metal conducting element or compound, semiconductor or composite.

Remarks

The examiner's reconsideration of the application is requested in view of the various amendments above, attachments hereto and comments which follow.